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REVIEWS

Preliminary Report on the Deposits of Manganese Ore in the Batesville District, Arkansas. By HUGH D. MISER. Bulletin 715-G, United States Geological Survey, Government Printing Office, Washington, D.C., 1920. Pp. 93–124 (32), pls. 3, figs. 4, bibliography, tables, and analyses.

The Batesville manganese district is in the southern part of the Ozark region, in Independence, Sharp, Izard, and Stone counties, in north-central Arkansas. The deposits have been worked intermittently since 1849. They lie in a region of rough topography but of no great relief. In the manganese-bearing areas the following formations are exposed:

Age	Formation
Mississippian	Boone shert
Ordovician	Cason shale
	Fernvale limestone
	Kimmswick limestone
	Plattin limestone
	Joachim limestone
	St. Peter sandstone

The Cherty Fernvale limestone is the principal source of manganese ore. Its weathering leaves cherty nodules and sticky residual clay, varying in color from yellow to red. The overlying thin Cason shale bears phosphate, here as pebbles almost an inch in diameter, there as shell fragments or grains; such phosphate deposits have, however, not been extensively worked. The only fossils in the formation are flattened "buttons" of supposedly algal origin, composed of calcium or manganese carbonates; the "buttons" may occur in great quantity in the residual clay, as at the Cason mine.

Structurally the beds are almost flat-lying; a general doming of the region has given them a gentle dip southward, upon which are superimposed several minor flexures. There are seven small normal faults, with a throw not exceeding 400 feet. An uncomformity separates Mississippian and Ordovician beds and four others occur in the Ordovician sequence.

The manganese minerals are psilomelane, hausmannite, braunite, manganite, pyrolusite; and wad. Psilomelane is most abundant. Iron oxides (limonite and hematite), and ferruginous manganese ores (hematite and limonite with psilomelane), barite, quartz, calcite, arsenopyrite, and sulphides of the heavy metals are also associated with the ores. The workable manganese and ferruginous manganese deposits occur under the following conditions: (1) replacement deposits in the Cason shale and its residual clay; (2) replacement deposits in the Fernvale limestone; (3) residual deposits from the Fernvale limestone; (4) replacement deposits in clays; (5) transported stream-gravel deposits. Of these, (3) is most important as a source of manganese ores, and (1) has furnished more ferruginous manganese. The replacement deposits in the Cason shale and its residuum occur in irregular masses, "buttons," or horizontal seams and beds; "buttons" of red iron oxide are also found under similar conditions. The occurrence of manganese-bearing calcite suggests that all the manganese oxides were derived from the carbonate. A similar origin for the manganese replacements in the Fernvale limestone is well demonstrated by deep cuttings in the district: here cores of carbonate are found surrounded by envelopes of oxides of manganese and ferruginous manganese.

The largest yield of manganese ore, the largest reserves, and a considerable part of the low-grade ore output comes from the residual deposits of the Fernvale or lower limestones, into the deeper portions of which the nodules were settled by gravity or were washed by streams. The decomposition of the limestone has formed manganese-bearing surface hollows and channels; elsewhere manganese-bearing caves and sinks have developed. Slumping and sinking of the soft, plastic clay (and of the overlying Cason shale) have greatly disturbed the ore bodies. These residual deposits consist of psilomelane, hausmannite, wad, and, subordinately, braunite. The hard oxides may occur as bowlders that weigh as much as 22 tons; generally the coarser the masses, the more free the ore from iron and the higher its grade.

Some small deposits of manganese oxides have been formed by the introduction of manganese into the clays through the action of ground waters; such manganese probably came from the Cason shale or Fernvale limestone. These ores are low grade and diluted though the presence of silica, iron, and alumina.

Finally some manganese is obtained from alluvial cones and gravel bars, the deposits being composed of compact masses of manganese oxides, and of small pebbles of oxide of iron. Many of the largest concentrations lie in synclines, for reasons which the writer hopes to demonstrate in a later paper.

Most of the high-grade ores bear from 45 to 52 per cent of manganese, but many otherwise good deposits bear too much phosphorous to justify exploiting them. "Hand-picked" ore is the highest grade. The ore is not used for chemical purposes, but is employed in various high-manganese iron and steel products; it is also of importance in making brown, gray, and speckled bricks, when mixed with clay.

The manganese reserves probably amount to 250,000 tons of 40 per cent manganese. The deposits are covered to the south by younger formations, and could probably not be extensively worked in that direction anyway, since concentration and oxidation have not been extensive under the heavy capping.

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Magnesite Deposits of Grenville District, Argenteuil County, Quebec. By M. E. Wilson. Memoir 98, Canadian Geological Survey, Ottawa, 1917. Pp. 88, figs. 2, pls. 11, maps 3.

This district is bordered by the Ottawa River on the south and is about halfway between Ottawa and Montreal. The magnesite deposits are about ten miles north of the Ottawa River.

Chapter i gives information of general interest about magnesite, its uses, foreign source of supply, other Canadian magnesite deposits, and the history of magnesite mining in Grenville district.

Chapter ii is a brief statement of the geology of the district. The oldest rocks belong to the Grenville sedimentary series and are intruded by pyroxene-rich gabbro, diorite, and syenite belonging to the Buckingham series. These two series are intruded by batholithic masses of granite-syenite gneiss. All these rocks are intensely metamorphosed and are Early pre-Cambrian in age. These Early pre-Cambrian rocks are intruded by diabase dikes and a stocklike mass of granite-syenite probably of Late pre-Cambrian age. The Paleozoic is represented by the Potsdam, Beekmantoan and Chazy formations named in ascending order. Glacial bowlder clay and gravel and Champlain marine clay form an irregular mantle over the bed-rock surface.

Chapter iii gives a description of the magnesite deposits and their origin. The magnesite is associated with serpentine, dolomite and other minerals in the metamorphosed Grenville sediments and close to outcrops of the pyroxenic rocks of the Buckingham series. The deposits are lens-shaped and the material is banded, the banding being due to